
Trends in Availability of Foods and Nutrients: A Comparison Between the United States and Italy, 1961-92

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The Mediterranean diet is of interest for its health-promoting qualities. The purpose of this study is to better define this diet and to compare it with the U.S. diet. We examined U.S. and Italian food-balance sheet data for 1961-92. Per capita per year food estimates show less available whole milk and white potatoes in both countries, less eggs and red meat in the United States, and less grain in Italy. Italy had higher per capita estimates for grains, cheese, oils, vegetables, and noncitrus fruits, while the United States had higher estimates for dairy foods, citrus fruits, eggs, and sugars and sweeteners. Nutrient levels increased for both countries, except for lower carbohydrate levels in Italy. Vitamin A, thiamin, riboflavin, niacin, and iron levels were higher for the United States; vitamin C, calcium, phosphorus, and potassium levels were higher for Italy. The considerable changes in the diets of both countries in the past 30 years have implications for health, in particular, the incidence of coronary heart disease and other diseases with acknowledged nutritional etiology.

During the early 1960's, people living in the Mediterranean area had some of the highest life expectancies and lowest rates of coronary heart disease, certain cancers, and other chronic diseases in the world. Unable to attribute these favorable health statistics to educational level, financial status, or health care expenditures, nutrition researchers have focused on the diet in this area (23). The role of the Mediterranean diet in the prevention of coronary heart disease was first described by Keys in the 1950's (11). Keys showed that Italian men living in Naples in the early 1950's had diets in which fat

contributed 20 percent to their total energy; whereas, a comparable American group had diets in which fat contributed 40 percent of their energy. He demonstrated that higher fat diets were associated with higher concentrations of serum cholesterol in men and consequently with a higher risk of atherosclerosis (9). Keys and his coworkers initiated in the early 1950's the Seven Countries Study that lasted for more than 20 years. This landmark study confirmed his previous findings: dietary fat influences levels of human serum cholesterol that influence the risk of coronary heart disease (10).

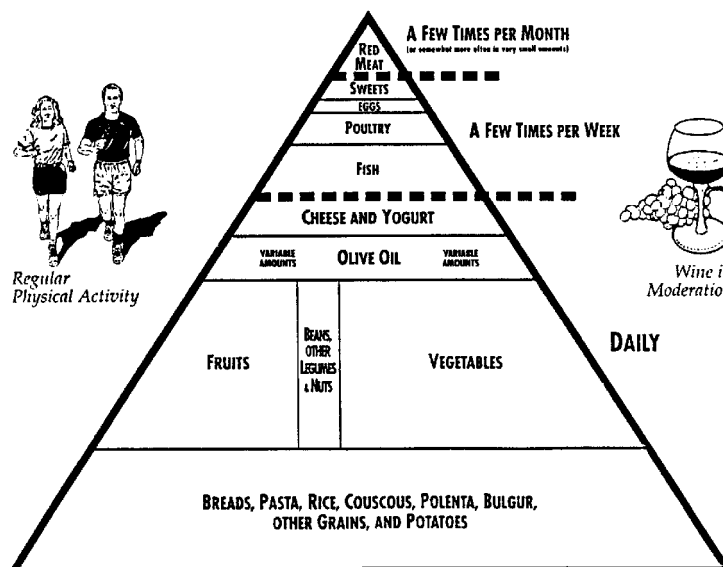
The desire to preserve traditional diets likely to foster good health prompted the World Health Organization (WHO), the Food and Agriculture Organization (FAO) Collaborating Center in Nutritional Epidemiology at Harvard School of Public Health, the WHO Regional Office for Europe, and Oldways Preservation & Exchange Trust to develop the Mediterranean Food Guide Pyramid (fig. 1) (23). These organizations depicted the Mediterranean diet as a graphic similar to the Food Guide Pyramid released by the U.S. Department of Agriculture (fig. 2) (20). The Mediterranean Food Guide Pyramid depicts a general sense of the relative proportions and frequency of servings of foods and food groups that constitute the Mediterranean diet (23).

The term “Mediterranean diet” has been broadened to include primarily plant-based diets with olive oil as the major source of fat. At least 16 countries along the Mediterranean Sea in which this dietary pattern was possible are Egypt, Morocco, Syria, Tunisia, Turkey, Algeria, Greece, Albania, Israel, Spain, Italy, France, Croatia, Lebanon, Libya, and Malta (23).

The purpose of this study is to better define the Mediterranean diet and to compare it with the American diet in terms of food use and nutrient contributions. We examined U.S. and Italian food-balance sheet data, the best available source of information to examine dietary trends over time. Thus, the data are often used for international comparisons (11). We chose Italy to represent the Mediterranean area because food composition and edible portion data were available for this country.

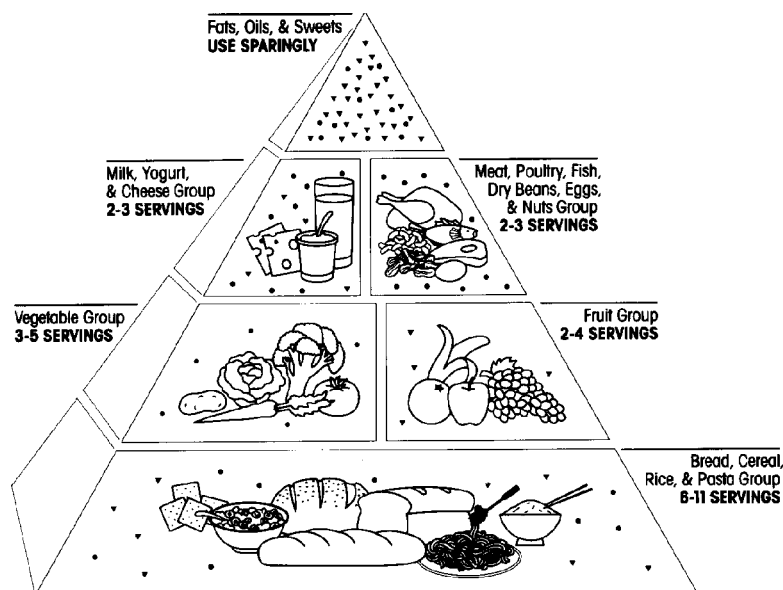
Within and between country data on trends for foods, nutrients (food energy,

Figure 1. Mediterranean Diet Pyramid



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Figure 2. USDA Food Guide Pyramid



protein, carbohydrate, and fat; five vitamins, and four minerals) and sources of food nutrients were calculated and compared. Adequate vitamin A and vitamin C prevents night blindness and scurvy, respectively. Both are important antioxidants. Adequate thiamin prevents beriberi, and in addition to it, riboflavin and niacin are involved in energy metabolism. Calcium and phosphorus are important for their structural functions in bone. Iron is important in preventing iron-deficiency anemia, and potassium is also important in transportation across cell membranes and in the metabolism of energy.

In addition, we investigated whether the idealized Mediterranean diet still existed and the changes that may have occurred to this dietary pattern. By quantitatively examining the similarities and differences between the two countries' food supplies, we are able to discuss the feasibility of implementing in the United States the Mediterranean diet as a guidance model.

Methods

The nutrient content of the U.S. and the Italian food supply was calculated as similarly as possible for 1961-92.¹ Generally, both sets of data were estimated by multiplying the amount of each food consumed by the amount of food energy and other nutrients in the edible portion of food. The other nutrients were carbohydrate, protein, fat, vitamin A, ascorbic acid, thiamin, riboflavin, niacin, calcium, phosphorus, iron, and potassium. The data on U.S. food per capita were converted to kilograms for ease of comparison. Results

for each nutrient for all the foods were totaled, and amounts per capita per day were generated. An interactive system² written in Foxpro, a relational database management program, was used to calculate each set of values of nutrients per capita per day. This system, maintained by the USDA's Center for Nutrition Policy and Promotion (CNPP), contains nutrient estimates from as far back as 1909. These estimates are updated on a continual basis to reflect the most up-to-date food composition.

Two databases for each country were needed to calculate nutrient per capita: one on food per capita and another on nutrient composition. The USDA's Economic Research Service (ERS) annually calculates U.S. food per capita values for most commodities. The U.S. Department of Commerce's National Marine Fisheries Service provides fish and shellfish values. The USDA's Agricultural Research Service (ARS) provides nutrient composition data. Italian food per capita values were obtained from FAO, and the nutrient database was based on the Italian National Nutrition Institute's (INN) *Tabelle di Composizione degli Alimenti*³ (2).

Food Database Development

Food-balance sheet data, also referred to as food supply, food availability, disappearance data, and consumption are accounts of food supplies that "disappear" into the national marketing system. The estimates of food are referred to as "disappearance data" because of the method by which they are derived. Supply tables are constructed from data on production, imports, and beginning-of-the-year inventories;

whereas, utilization tables are from data on exports, year-end inventories, and nonfood uses. The amount of food from the utilization table is subtracted from the amount in the supply table.

The resulting food has "disappeared" and is assumed to be consumed by the population. Data on food composition and edible portions of food are then used to calculate the nutrients available in the food supplies. Dietary comparisons between countries are possible because these data are all derived in this manner. Differences between the U.S. and Italian food supplies are therefore "real" and not an artifact of different procedures. Despite the limitation that data on the food balance do not directly measure dietary intake, these data can be used to estimate the dietary patterns of the Mediterranean region in the early 1960's (8). Roughly 400 primary commodity foods are included in the U.S. data set. A more detailed discussion of the methods for the estimates of U.S. nutrients per capita is presented elsewhere (7).

FAO provided a spreadsheet of the amounts of about 300 foods used by the Italian population on a yearly basis from 1961 to 1992 (4). In addition, FAO supplied estimates of the Italian population for those years. Food estimates used in this study were divided by the appropriate population estimates to yield values on a kilogram per capita per year basis. About 200 primary commodity foods are included in the Italian data set. A more detailed discussion of the methods for the Italian nutrient per capita is presented elsewhere (24).

Refuse and Edible-Portion Factors

We used refuse factors from USDA's Nutrient Data Base for Standard Reference Release No. 10 (18) to calculate

¹The year ranges are 1961-65, 1966-70, 1971-75, 1976-80, 1981-85, and 1986-92.

²The system was written by FU Associates, Ltd. (Arlington, VA).

³Food Composition Table.

the amount of edible food in the food supply. These factors were used to adjust food amounts so that inedible parts of foods (such as bones, rinds, and seeds) are not included. When a refuse factor for a food was not equal to zero, we multiplied the food amount by a value equal to one minus the refuse factor. Averages of refuse factors were calculated for some foods that were reported only as a single value for several food items.

Edible-portion factors for Italy were provided by the INN. If a food had an edible-portion factor with a value other than 100 percent, we multiplied the per capita amount of the food by its edible-portion factor. When FAO reported several foods as a total for a group of foods, such as whole freshwater fish, we calculated weighted averages of the edible-portion factors within the group. The method was based on the Italian reference diet as described by Turrini, Saba, and Lintas (14). When FAO values of food per capita were grouped together by the authors, the relative amount of each food in the group was used to develop a composite edible-portion factor. When too little information existed to calculate weighted edible-portion factors, we calculated averages for foods reported as groups.

Refuse factors are different from inedible-portion factors, but usually edible-portion factors are the refuse values subtracted from 100 percent. Refuse factors for the United States and inedible-portion factors for Italy were used to make the procedures for both countries as similar as possible and to account for food amounts that typically are not available for human consumption.

Differences in the Food Per Capita Data Sets

A method to estimate production from home gardens has been developed for estimating the nutrient content of the U.S. food supply. This method incorporates household consumption data from USDA's Nationwide Food Consumption Surveys (17) and the percentage of households with vegetable gardens from the National Gardening Association's National Gardening Survey (1). Data on vegetable consumption were derived for the years in which USDA's surveys were conducted and then interpolated for the years between surveys by using the percentage of households with gardens.

Vegetables produced in small family gardens are not included in the FAO's statistics on food. Estimates have shown that vegetables grown in family gardens in Italy comprise almost 20 percent of the total production of vegetables (3). Thus, some nutrient per capita values could be underestimated because these sources of nutrients could not be included in estimating the nutrient content of the Italian food supply, particularly those values for nutrients such as vitamin A, ascorbic acid, and potassium that are concentrated in vegetables.

For both countries the nutrients provided by alcoholic beverages are excluded from the estimates of nutrients per capita. Vitamins and minerals added to the food supply through drinking water and supplements are also excluded in each set of estimates of nutrients per capita.

Nutrient Data Base Development

Sources of Data

Data on U.S. nutrient composition were obtained from the Primary Nutrient Data Set (PDS), which was developed by ARS's Nutrient Data Laboratory for the 1994 Continuing Survey of Food Intakes by Individuals (19). In addition, food specialists in the Nutrient Data Laboratory developed nutrient profiles for unique items in the food supply. Nutrient data provided on a per 100 gram basis were converted to a per pound basis.

A nutrient database on a per kilogram basis was developed based on the Italian per capita food use estimates. Most of the nutrient values were taken from *Tabelle di Composizione degli Alimenti* (2), maintained by the INN. Modifications and additions were also made to this nutrient database so that nutrient profiles corresponded to food data.

In some cases, nutrient information that corresponded to foods reported by FAO did not exist in the INN database. For these foods, we imputed nutrient values from either USDA's 1991 Primary Nutrient Data Set (16), its 1976-1992 Agriculture Handbooks (AH-8) (15), or its 1963 Agriculture Handbook (22). The most recent source of USDA data was used in all cases.

Differences in the Nutrient Composition Data Sets

The values of nutrients per capita for the United States include estimated nutrient amounts added to the food supply through fortification and enrichment. The nutrient amounts from fortification and enrichment were based on data from surveys of industry conducted by the Bureau of Census for USDA (5) and on advice about flour

In both countries, the per capita per year amounts of most foods available for consumption increased.

enrichment from authorities in the milling and baking industries (13). Estimated nutrients include iron, thiamin, riboflavin, and niacin added to flour and cereal products; vitamin A added to margarine, milk, and milk extenders; and vitamin C added to fruit juices and drinks, flavored beverages, dessert powders, milk extenders, and cereals. No comparable information was available for Italy.

Another difference between these two data sets is the adjustment of the data on nutrient composition to reflect technological and marketing innovations over time. In the United States, for example, changes in animal husbandry and closer fat-trimming practices by the meat industry have lowered the fat content of beef and pork since the late 1970's (6). To account for these changes, nutrient values for beef and pork have been updated since the mid-1970's. Data were not available to determine if such changes existed in the Italian food supply; thus, we assumed that the nutrient composition of foods used for the Italian data set has not changed over time. The nutrient composition of most foods in the U.S. food supply did not change between 1961 and 1992. The major exceptions are the lower fat content of beef and pork, the varying fat content of poultry, and the higher vitamin A content of deep-yellow vegetables.

Results

Major Contributors Affecting the Availability of Food

In both countries, the per capita per year amounts of most foods available for consumption increased (table 1). Notable exceptions included less whole milk and white potatoes in both countries, less eggs and red meat in the United

States, and less grains in Italy. Over the years, use of whole milk dropped by 61 percent in the United States and 28 percent in Italy. Initially, milk use in the United States was almost double its use in Italy. Later, with the large drop in the use of milk in the United States, both countries had similar use. Cow's milk was the predominant type of milk in both countries. In Italy, however, milk from other animals, such as goat, ewe, and buffalo was more common, particularly in cheesemaking. Generally, the use of white potatoes in both countries was similar and decreased by 11 percent in the United States and 14 percent in Italy. While the use of eggs in the United States surpassed that of Italy over the series, their use in the United States dropped by 23 percent between 1961-65 and 1986-92.

Italian per capita values for grain products, cheese, tomatoes, noncitrus fruits, other vegetables, and oils were all higher than U.S. values. For most of the years, the use of Italian grains was double that of the United States. However, a decline in the use of grains in Italy in 1986-92 resulted in Italian use being less than double but still substantially higher than U.S. use. Cheese use in both countries doubled between 1961-65 and 1986-92. However, cheese use was initially greater in Italy; thus, the Italian increase was considerably larger, causing the difference between the two countries to become greater.

The use of vegetables and fruits was substantially higher in Italy than it was in the United States. For example, Italians' use of tomatoes doubled, then tripled, that of the Americans' use, and the use of "other vegetables"⁴ in Italy

⁴Artichokes, asparagus, green beans, cabbage, cucumbers, eggplants, lettuces, garlic, mushroom, and cauliflower were counted in this group.

Table 1. Foods per capita per year in the U.S. and Italian food supplies¹

Food group	1961-65		1966-70		1971-75		1976-80		1981-85		1986-92	
	U.S.	Italy	U.S.	Italy	U.S.	Italy	U.S.	Italy	U.S.	Italy	U.S.	Italy
<i>Kilograms</i>												
Dairy	151.7	74.9	144.1	71.2	138.0	87.2	134.7	95.4	128.5	102.8	128.4	85.1
Whole milk	116.4	61.6	104.6	54.2	89.8	66.2	73.1	66.4	59.4	70.7	45.0	48.0
Lowfat milk	13.3	4.2	18.4	5.3	27.4	7.5	40.0	13.5	45.4	13.3	56.5	15.3
Cheese	6.3	8.2	7.0	10.0	8.4	11.2	9.7	12.6	11.2	15.3	12.7	17.0
Eggs	18.5	8.3	18.3	8.8	17.0	10.0	15.8	10.3	15.2	10.3	14.2	10.7
Fats and oils	22.5	18.1	24.5	21.9	25.4	25.4	26.6	27.0	28.5	28.7	30.2	31.7
Fats	16.7	3.9	17.2	4.2	16.6	5.3	16.6	6.5	17.8	7.1	18.2	7.8
Oils	5.8	14.2	7.3	17.7	8.8	20.1	9.9	20.5	10.7	21.6	12.0	23.9
Meat, poultry, and fish	88.5	33.2	97.9	43.3	99.2	51.1	101.1	57.4	101.3	63.6	103.9	69.7
Red meat	64.8	21.8	70.1	28.9	69.5	34.2	68.5	37.9	65.2	41.9	60.6	45.7
Poultry	17.4	5.1	21.0	7.5	22.3	10.1	24.8	12.3	28.3	13.2	34.7	13.6
Fish	6.3	6.3	6.8	6.9	7.4	6.8	7.8	7.2	7.9	8.4	8.6	10.4
Grains	66.1	131.6	65.6	132.8	64.4	134.5	67.5	132.5	70.7	117.7	84.4	116.3
Sugars and sweeteners	51.1	23.9	54.0	26.5	55.8	29.9	57.5	30.1	56.2	28.2	61.1	26.5
Fruits	74.7	95.9	77.1	110.7	82.4	106.9	86.6	98.5	90.1	104.4	95.6	111.2
Citrus	22.9	13.6	27.0	22.2	32.5	27.0	33.6	27.7	32.4	28.4	31.3	29.1
Noncitrus	51.8	82.3	50.1	88.5	50.0	79.9	53.0	70.8	57.7	76.0	64.3	82.1
Vegetables	124.3	157.1	110.6	176.0	124.8	168.7	126.0	168.6	125.5	180.2	126.2	189.4
White potatoes	40.7	41.7	38.3	38.8	36.6	33.7	36.2	33.4	35.7	32.6	36.4	35.8
Tomatoes	16.7	35.0	16.4	43.9	20.3	39.9	20.5	41.0	20.4	53.4	20.5	60.6
Dark-green/deep-yellow vegetables	11.1	12.8	10.7	14.9	10.9	15.7	10.8	14.8	11.8	15.0	12.1	16.2
Other vegetables	55.7	69.5	55.9	80.5	56.9	81.6	58.5	81.6	57.6	81.3	57.2	78.9

¹Values are the average for each year range.

was greater throughout the entire series and increased by 14 percent. Among the vegetables in this group, artichokes, cucumbers, eggplants, and cauliflower were consumed in much larger quantities in Italy than in the United States; the use of sweet corn, however, was common in the United States but negligible in Italy. In 1961-65, the use of dark-green and deep-yellow vegetables was similar in the two countries and increased. By 1986-92, Italian use of these vegetables was 34 percent higher than their use in the United States.

Originally, Italian use of noncitrus fruit was almost 60 percent greater than its use in the United States; by 1986-92 this difference was reduced to 28 percent. Additional analysis showed that the most common noncitrus fruits in both countries are apples, bananas, peaches, pears, grapes, strawberries, plums, cherries, cantaloupes, and watermelons. While figs and persimmons were more common in Italy, pineapples were more common in the United States.

The use of red meat, poultry, lowfat milk, citrus fruit, fats, and sugars and sweeteners was greater in the United States than in Italy. While the use of red meat in the United States was always greater than that in Italy, the pattern of use between the two countries differed. In Italy, the use of red meat more than doubled (21.8 to 45.7 kilograms per capita per year) over the period; in the United States, the use of red meat increased through the 1960's and then from 1966-70 to 1986-92, its use decreased by 14 percent. Also, the use of edible offals from animals such as cows, pigs, horses, and chickens in Italy was appreciable; in the United States the use of offals was negligible (data not shown). The use of fish in the

two countries was the same initially, but by 1986-92, it was 21 percent higher in Italy than in the United States.

The use of dairy foods and citrus fruits for all years was higher in the United States than in Italy. The use of lowfat milk in the United States rose considerably, with use in 1986-92 almost four times its use in Italy. Although the use of citrus fruit was higher in the United States, a marked increase in its use by Italians narrowed the difference between the two countries—from 68 percent in 1961-65 to 8 percent in 1986-92.

The use of oil in Italy was 2 to 2½ times greater than its use in the United States; this difference narrowed in later years, however. When we examined the oil food group in more detail, we found that olive oil was the predominant oil in Italy in the earlier years (data not shown). In 1961-65 the amount of olive oil used per capita per year exceeded that of all other types of oils, including oil from maize, palm kernel, rapeseed, sesame, soybean, and sunflower. By 1986-92, however, the sum of these other oils was greater than the amount of olive oil in the Italian food supply. Use of oils, particularly soybean oil, in the United States has practically doubled.

Initially, the use of fats (butter, margarine, shortening, and lard) by the United States was more than four times that of Italian use. Because of the subsequent increase in the use of fats in Italy, the United States was using no more than twice as much as Italy used. Throughout the series, the use of sweeteners in the United States was twice their use in Italy.

Macronutrients

In the United States and Italy, levels of food energy increased by 17 and 18 percent, respectively (table 2). Despite the similar percentage increases, the United States consistently had higher levels of food energy.

Even though food energy in both countries increased consistently over the years, the relative contributions from carbohydrate, protein, and dietary fat changed in Italy but remained rather stable in the United States. From 1961-65 to 1986-92, the contribution of dietary fat to total food energy increased from 28 to 37 percent in Italy and remained stable at about 40 percent in the United States (fig. 3). The contribution from carbohydrate decreased from 61 to 49 percent in Italy but increased slightly in the United States: from 48 to 50 percent. The protein contribution to total energy for both countries remained stable: 12 percent for the United States and 13 percent for Italy.

Trends for the actual macronutrient levels (amounts available in the food supply) were more dramatic than their relative contributions to energy indicate (table 2). The most pronounced trend was for dietary fat. Between 1961-65 and 1986-92, Italian fat levels increased by 70 percent, quite a difference from the increase in the U.S. fat levels: 13 percent. Although Italian fat levels increased so dramatically, the United States still had higher fat levels for all years. However, the difference between the two countries narrowed from 71 percent in 1961-65 to 14 percent in 1986-92.

There were several differences in fat sources between the two countries (fig. 4). Oils were the primary source of dietary fat in Italy throughout the

Table 2. Food energy and macronutrients, vitamins, and minerals per capita per day in the U.S. and Italian food supplies, selected year ranges

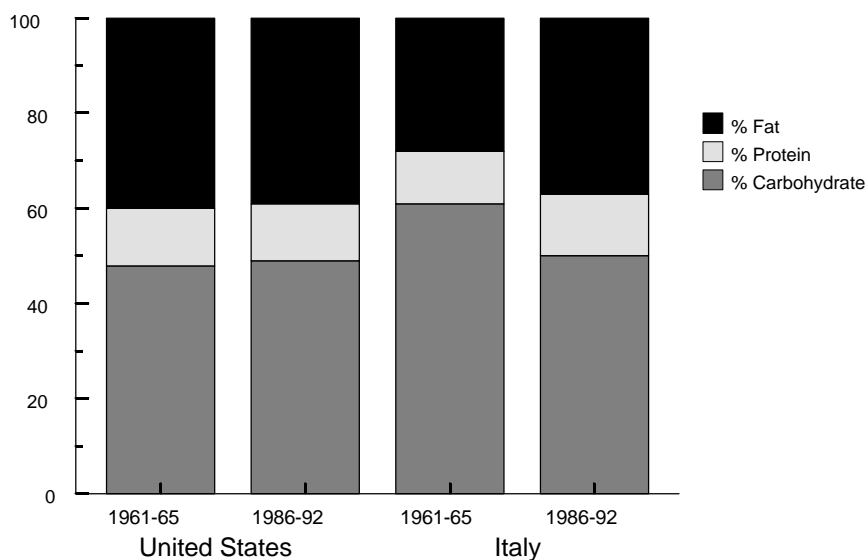
Food energy and macronutrients								
Years	Food energy		Carbohydrate		Protein		Fat	
	U.S.	Italy	U.S.	Italy	U.S.	Italy	U.S.	Italy
	<i>Kcal</i>		<i>Grams</i>		<i>Grams</i>		<i>Grams</i>	
1961-65	3124	2849	374	437	91	89	140	82
1966-70	3259	3073	382	452	94	98	151	97
1971-75	3283	3258	386	459	94	104	151	112
1976-80	3337	3315	399	454	96	108	151	119
1981-85	3405	3274	403	421	98	109	156	128
1986-92	3641	3372	449	416	105	113	158	139

Vitamins										
Years	Vitamin A		Vitamin C		Thiamin		Riboflavin		Niacin	
	U.S.	Italy	U.S.	Italy	U.S.	Italy	U.S.	Italy	U.S.	Italy
	<i>mcg RE</i>		<i>Milligrams</i>		<i>Milligrams</i>		<i>Milligrams</i>		<i>Milligrams</i>	
1961-65	1264	902	91	177	1.8	1.7	2.2	1.5	20	21
1966-70	1407	1071	98	210	1.9	1.9	2.2	1.6	21	23
1971-75	1536	1170	108	212	2.1	1.9	2.3	1.8	23	24
1976-80	1533	1223	111	212	2.3	2.0	2.4	1.9	25	25
1981-85	1513	1341	112	219	2.3	2.0	2.4	1.9	26	25
1986-92	1509	1414	115	225	2.6	2.0	2.5	1.9	28	26

Minerals								
Years	Calcium		Phosphorus		Iron		Potassium	
	U.S.	Italy	U.S.	Italy	U.S.	Italy	U.S.	Italy
	<i>Milligrams</i>		<i>Milligrams</i>		<i>Milligrams</i>		<i>Milligrams</i>	
1961-65	902	718	1428	1482	14.2	14.9	3472	3328
1966-70	886	792	1449	1595	14.8	16.1	3465	3657
1971-75	873	868	1447	1684	17.0	16.8	3462	3691
1976-80	881	925	1471	1742	20.4	17.0	3465	3716
1981-85	888	985	1491	1753	17.5	17.0	3480	3846
1986-92	936	963	1608	1780	20.0	17.3	3657	3949

Although the use of citrus fruit was higher in the United States, a marked increase in its use by Italians narrowed the difference between the two countries—from 68 percent in 1961-65 to 8 percent in 1986-92.

Figure 3. Macronutrient sources of food energy in the U.S. and Italian food supplies, 1961-65 and 1986-92



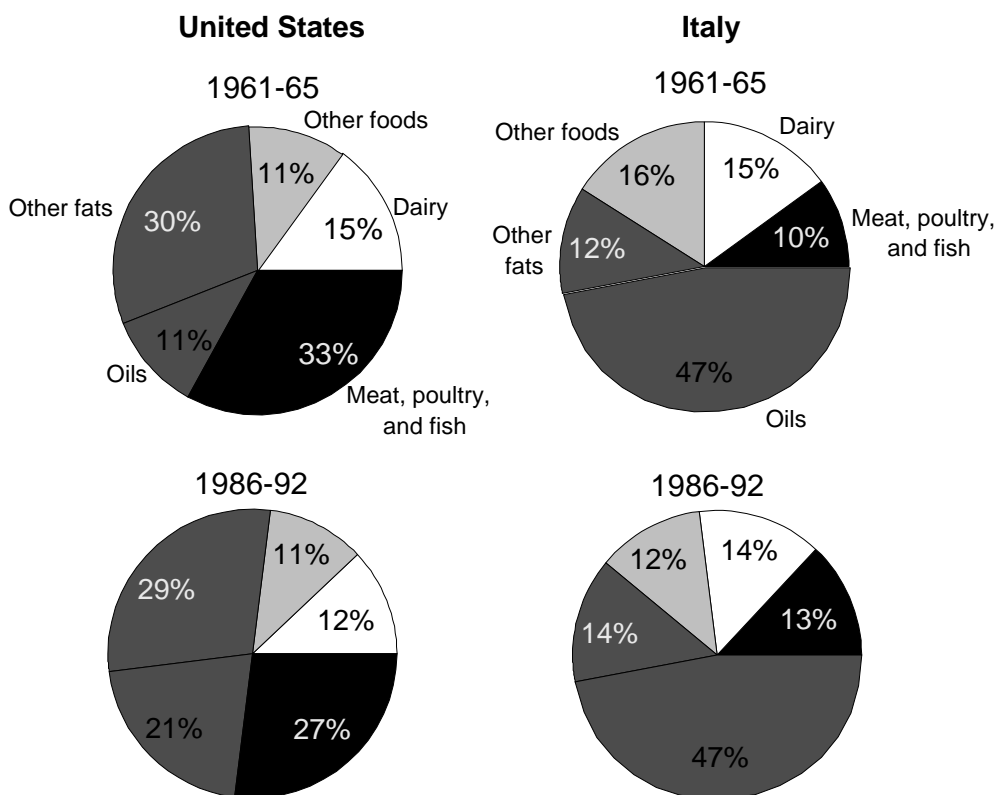
years; however, the types of oils shifted from olive oil to other oils. In the United States, while the contributions of dietary fat from oil increased, compared with use in Italy, margarine, shortening, and lard were used in greater quantities in the United States. Thus, U.S. oils contributed less than half the contributions from oils than was the case in Italy. Since the early 1970's, the use of red meat in the United States decreased. Despite the decreasing use of red meat by the United States since the early 1970's, the contribution of fat from the meat, poultry, and fish group between 1986-92 was twice that from this group in Italy.

The trends in carbohydrate levels were very different between the two countries. Initially, Italy had a higher carbohydrate

level by 17 percent (437 vs. 374 grams per capita per day); however, by the end of the period, the carbohydrate levels in the United States increased and surpassed those for Italy by 8 percent (449 vs. 416 grams). Increased use of sugars and sweeteners in both countries and an increased use of grains in Italy were responsible for increased carbohydrate levels. By the late 1970's, carbohydrate levels began to drop in Italy because of decreased use of grains.

The relative contributions of carbohydrate from most foods remained fairly constant for both countries (fig. 5). During both periods, the grains group was the primary source of carbohydrate in Italy, contributing more than half of the carbohydrate levels. In the earlier period, the sugars and sweeteners group and the grains group each provided

Figure 4. Sources of fat in the U.S. and Italian food supplies, 1961-65 and 1986-92



37 percent of the carbohydrate in the United States (fig. 5). By 1986-92, the major source of carbohydrate in the United States was the grains group, followed by the sugars and sweeteners.

Protein levels, similar in the earlier years, increased for both countries, with a 15- and 27-percent increase, respectively, in the United States and Italy (table 2). In the United States, the red meat group was the leading source of protein, providing between 26 and 23 percent (data not shown). In Italy the grains group was the largest source of protein for the entire period even though grain contribution dropped 14 percent. In Italy the relative contribution from the red meat group increased

during this period, while in both countries the protein contribution from poultry increased.

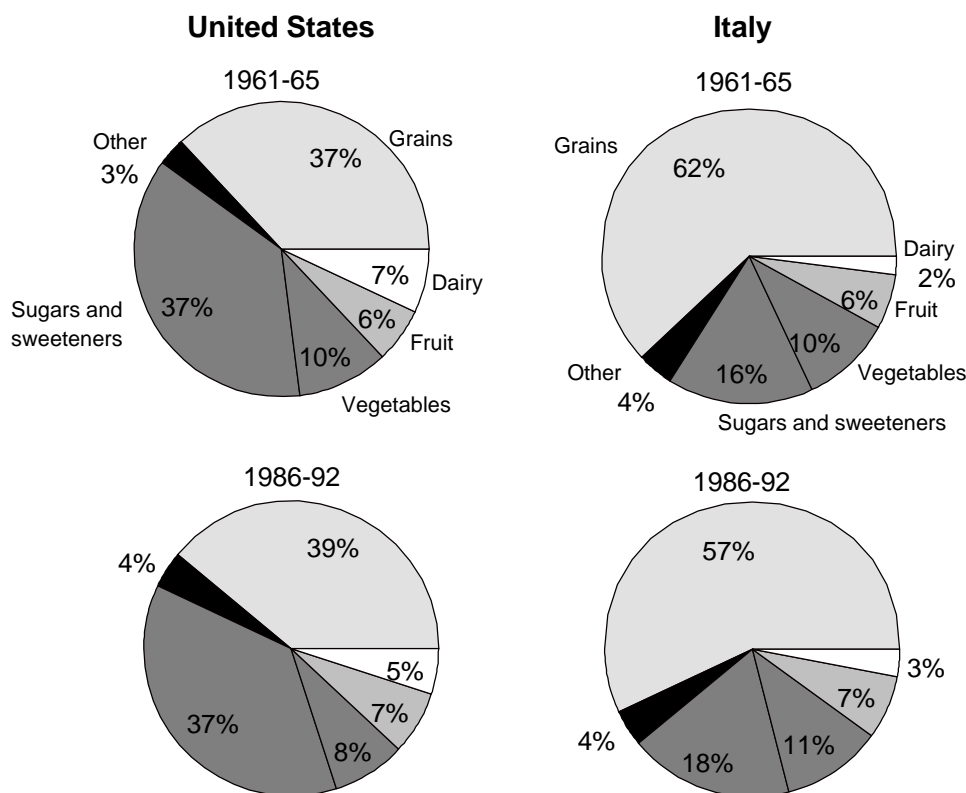
Vitamins

In both countries, vitamin levels have generally increased (table 2). The United States had higher levels for vitamin A, thiamin (particularly in later years), and riboflavin; whereas, Italy had much higher ascorbic acid levels. Niacin levels in both countries were initially similar; however, in the late 1970's, the niacin levels in the United States surpassed those in Italy.

Levels of total vitamin A, which includes both retinol and beta carotene, increased substantially (57 percent) in the Italian

food supply, narrowing the U.S. lead: from a 40- to a 6-percent difference in the levels between the countries in 1961-65 and 1986-92, respectively. The meat group, particularly organ meats, and dark-green and deep-yellow vegetables were leading sources of vitamin A for both countries (fig. 6). From 1961-65 to 1986-92, the vitamin A contribution from the vegetable group was about two-fifths (45 percent) and that from the meat, poultry, and fish group increased from one-fifth to one-fourth in the Italian food supply. At the same time in the United States, vitamin A contributions from the vegetable group increased from about one-fifth to one-third (23 to 34 percent), and meat contributions dropped from one-third

Figure 5. Sources of carbohydrate in the U.S. and Italian food supplies, 1961-65 and 1986-92



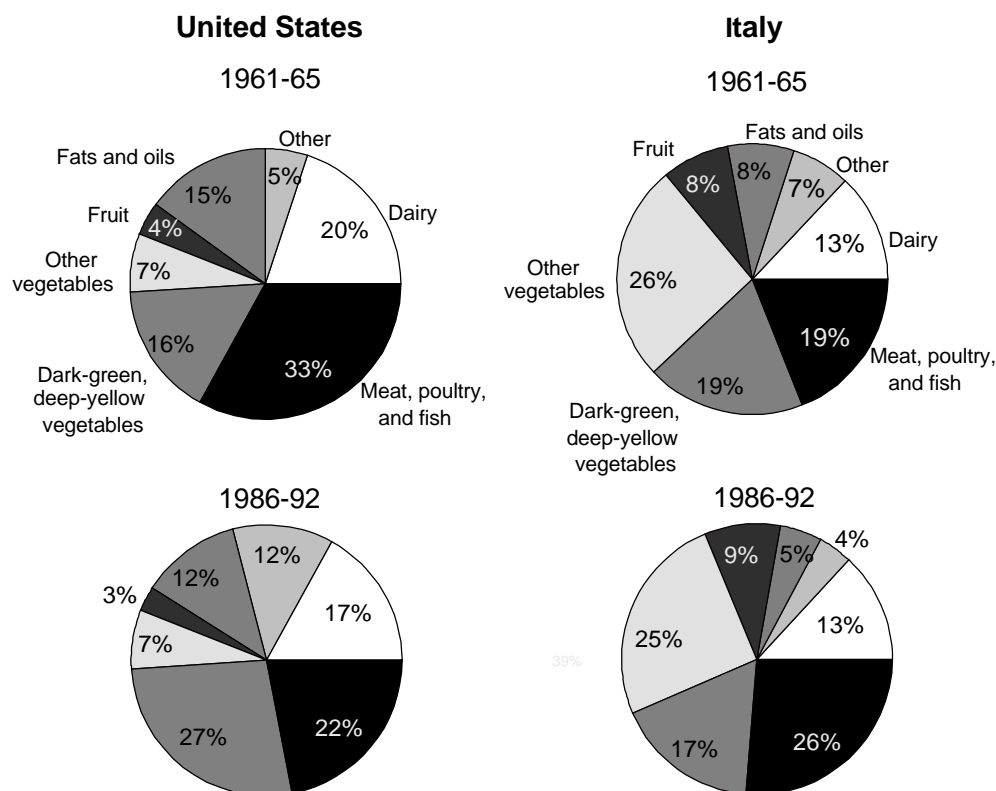
to about one-fifth (33 to 22 percent). The greater vitamin A contribution from the vegetable group in the United States was not from increased use but rather from the introduction in the mid-1960's of varieties of deep-yellow vegetables with more carotene than was true for earlier varieties. Another difference in contributions of vitamin A from the vegetable group was that in Italy, tomatoes (due to a sizable use over the years) were important contributors of vitamin A, unlike the trend in the United States. In the United States, because of the use of vitamin A-fortified margarine, the vitamin A contributions from fats and oils were appreciably higher, compared with

contributions of vitamin A from fats and oils in Italy.

Throughout the series, ascorbic acid levels in Italy were almost double the levels in the United States. In both countries, ascorbic acid levels increased: from 91 to 115 mg in the United States and 177 to 225 mg in Italy. The relative contribution from the various food groups was rather stable over the years (data not shown). Contributions from fruits and vegetables comprised 90 percent or more of the levels of total ascorbic acid. In the later years of the series, fruit and vegetable contributions in the United States provided similar levels; in Italy, vegetables provided the majority of vitamin C.

Over the 30-year period, thiamin and riboflavin levels were higher in the United States than they were in Italy. In the United States, thiamin levels increased dramatically, by 44 percent; riboflavin levels increased by only 14 percent. Riboflavin levels in the United States rose from 2.2 to 2.5 mg (14-percent increase) per capita per day over the series; levels in Italy rose from 1.5 to 1.9 mg (27-percent increase). Also, niacin levels in the United States were higher than the levels in Italy at the end of the series. Higher levels of these nutrients in the United States were, in part, due to an increase in the use of grains, but more substantially, these levels were due to Federal enrichment of grain products. With a

Figure 6. Sources of vitamin A in the U.S. and Italian food supplies, 1961-65 and 1986-92



decrease in the use of red meat in the United States, its contributions to these three vitamins dropped from 23 to 17 percent for thiamin, 17 to 14 percent for riboflavin, and 29 to 20 percent for niacin (data not shown). A reverse trend occurred in Italy: thiamin contributions from the red meat group more than doubled, primarily reflecting an increase in pork use. Also, Italian riboflavin contributions from the meat, poultry, and fish group increased from 10 to 16 percent. Reflecting the drop in grain use in Italy, contributions from this group for thiamin declined from 46 to 36 percent, for riboflavin from 21 to 15 percent, and for niacin from 37 to 27 percent (data not shown).

In both countries, the riboflavin contribution from the milk group declined because use dropped. The relative importance of the vegetable group to the supply of riboflavin was different between the two countries throughout the series: the Italian vegetable group provided about 20 percent of the riboflavin; whereas, the U.S. vegetable group provided about 7 percent.

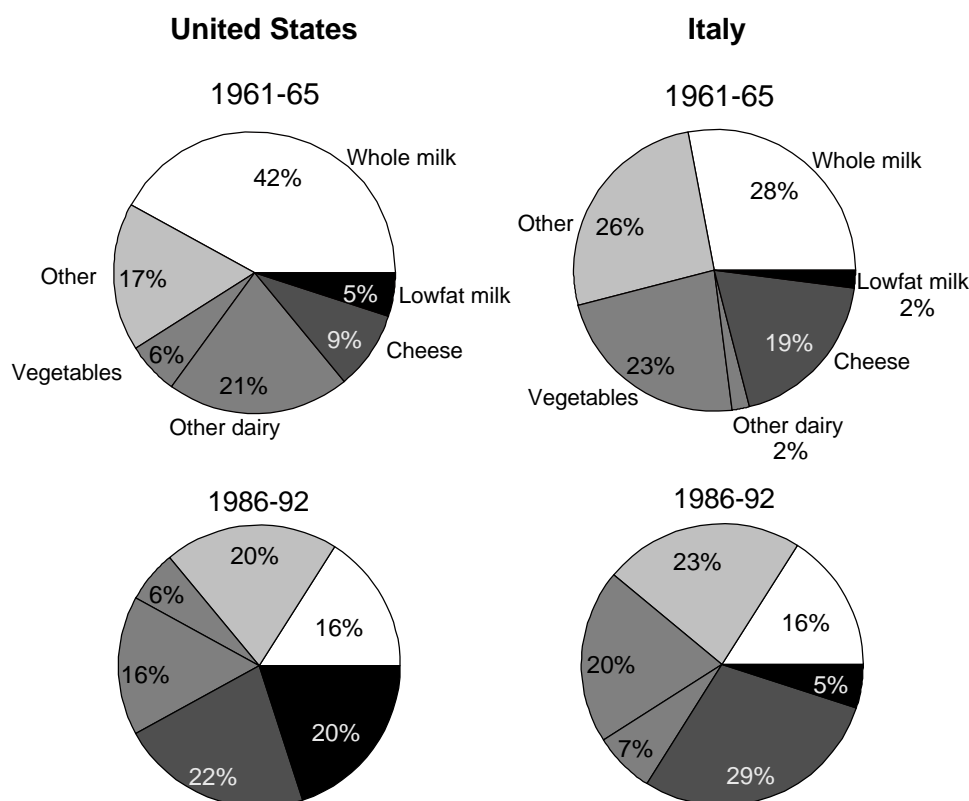
Minerals

From 1961-65 to 1986-92, the levels of calcium, phosphorus, iron, and potassium in the food supplies of both countries generally increased (table 2). Italian calcium levels surpassed those of the United States during the late 1970's. From 1961-65 to 1966-70,

Italian potassium levels increased by 10 percent and quickly outpaced the rather stable U.S. levels. The primary source⁵ of potassium in both food supplies was the vegetable group. The other sources of potassium differed in their importance between the two food supplies. Other major Italian food sources were grain products and fruits. Higher levels of potassium in Italy were mainly due to increased contributions from the meat, poultry, and fish group. Contributions from Italian dairy products remained stable at 9 percent but were minor compared with U.S. dairy product contributions, which provided about one-fifth of the total potassium throughout the years.

⁵Data on sources of potassium are not shown.

Figure 7. Sources of calcium in the U.S. and Italian food supplies, 1961-65 and 1986-92



Iron levels were similar for both countries in the early years, but by the mid-1970's, U.S. levels were higher (20.4 vs. 17 mg). Italy had higher phosphorus levels for the entire period: 1,482 to 1,780 mg versus 1,428 to 1,608 mg for the United States.

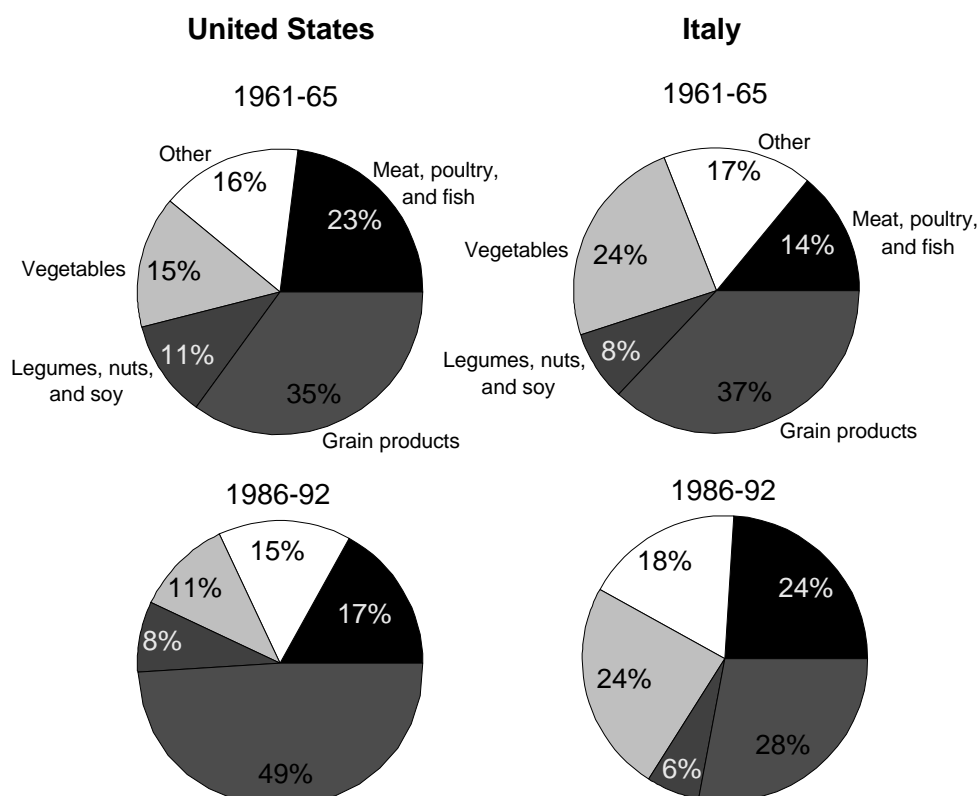
Calcium levels in the Italian food supply increased by 34 percent, while U.S. levels fluctuated slightly but by 1986-92 were similar to the Italian level. Throughout the period, dairy products were the primary calcium source in both countries; however, over the years, dairy products provided 50 to 60 percent of the calcium in the Italian food supply and 74 to 77 percent of the calcium in the U.S. food

supply (fig. 7). In both countries, the contributions from cheeses and lowfat milks increased; the contributions from whole milks decreased. In the United States, the contribution of cheeses to calcium levels more than doubled, low-fat milk quadrupled, and whole milks dropped by more than half.

In the United States, calcium contributions from the vegetable group were small (6 percent), compared with contributions from this group in the Italian food supply: around one-fifth (20 to 23 percent) of the total calcium in the Italian food supply, the result throughout the series of the ample use of many vegetables—particularly tomatoes and dried onions.

U.S. and Italian food sources of phosphorus differed (data not shown). In Italy, the primary source of phosphorus was the grain group; in the United States, the dairy group was the primary source. However, the share of phosphorus provided by grain products to the U.S. food supply increased, while the share in the Italian food supply dropped but continued to be the major source. The dairy group (especially cheese) became a more important source of phosphorus in the Italian food supply over the years, increasing from 18 to 22 percent. Also, the contributions from the meat, poultry, and fish group increased in the Italian food supply; in the United States, this group's contributions remained stable. Phosphorus contributions from vegetables

Figure 8. Sources of iron in the U.S. and Italian food supplies, 1961-65 and 1986-92



in the Italian food supply were about two times greater than those from vegetables in the U.S. food supply. The contributions from vegetables were relatively stable in both countries.

Per capita per day levels of iron in the two countries increased over the years; however, U.S. iron levels became noticeably higher in the mid-1970's because of enrichment and fortification practices. Grain products were the predominant source of iron for both countries (fig. 8). The relative contributions from grains decreased in the Italian food supply (37 to 28 percent), while those from the meat, poultry, and fish group (14 to 24 percent), particularly pork, increased. In the United States,

the trend reversed—grains contributed more (35 to 49 percent) and meat, poultry, and fish less (23 to 17 percent). For Italy, the vegetable group remained a stable and important source of iron to the food supply (24 percent). In the United States, this group contributed a moderate but decreasing amount of iron (15 to 11 percent). In both countries, the legumes, nuts, and soy products provided modest amounts of iron throughout the series.

Conclusions

Discussion

Interest in the Mediterranean diet started with the work of Ancel Keys. In 1952, he and several colleagues

undertook dietary and other coronary-risk studies in seven countries. After examining the results from these different countries, he was one of the first to link high-fat diets to higher concentrations of blood cholesterol and a subsequent increased risk of heart disease. To help individuals reduce their risks for coronary heart disease, he wrote a cookbook in which he summarized his findings and provided advice for a healthy lifestyle. Nestle (11) surmised that the Mediterranean diet of the 1960's was the prototype for current dietary guidance policy in the United States because the Dietary Guidelines for Americans (21) reflect the advice Keys outlined in his cookbook. This observation prompted us to compare the Mediterranean diet

to the U.S. diet in order to better quantify the characteristics of the Mediterranean diet.

Keys attributed the beneficial effects of the Mediterranean diet to the amount and type of fat consumed; however, in this study there were differences in the availability of other foods and nutrients. For example, vitamin C, calcium, phosphorus, and potassium levels were higher in Italy than in the United States. Thus it is difficult to ascertain if only one component, such as fat, is the only causative factor in the etiology of chronic diseases.

The successful implementation of dietary recommendations requires consumer access to affordable, health-promoting foods. From 1961-65 to 1986-92, substantial changes in the quantity and quality of foods in both countries resulted in different levels of nutrient availability. These different levels consequently caused the health-promoting attributes of these diets to be altered.

This study shows an increase in availability of fruits and grains in the United States and a shift to lower fat dairy and leaner meat products. However, along with these healthful trends, the U.S. food supply contains less dairy foods, more sugar and sweeteners, and more fat and oils in 1986-92 than in 1961-65. These trends resulted in higher levels of most vitamins and minerals; however, the 1986-92 levels of calcium (too low),⁶ total fat (too high), and calories (too high) may be a concern in terms of dietary guidance. As with the United States, the Italian food supply diet had

available for consumption more fruits and fats and oils in 1989-92 than in 1961-65. A healthful trend in Italy (not seen in the United States) was the increase in dairy products and vegetables available for consumption.

Trends that deviate from dietary guidance recommendation were the decreased use of grains and increased use of red meats and sugars and sweeteners in Italy. Determining the overall healthfulness of these two food supplies is difficult because the consumption of some foods came closer to dietary recommendations, and others deviated from dietary recommendations. Dietary quality is difficult to measure. The food supply of both countries must be able to provide healthful food choices.

For the U.S. population to consume a diet typical of the Mediterranean area in the 1960's, the availability of several food groups would need to change. When comparing the foods of Italy in 1961-65 to those in the United States in 1986-92, we found that Italy had less milk, cheese, eggs, fats, meat, chicken, fish, sugars, sweeteners, and citrus fruit available in 1961-65. Italy had more oils, grains, noncitrus fruit white potatoes, tomatoes, dark-green/deep-yellow and other vegetables available in 1961-65. As O'Brien (12) has noted, this would have significant implications for the agricultural sector in the United States. The current state of the U.S. food supply could not accommodate the estimated food needed for the U.S. population to adhere to a Mediterranean diet. However, whereas using the Mediterranean diet as a dietary guidance model in the United States might not be feasible at this time, the food industry has shown the capacity to adopt over time to changes in

consumer demands and changing public policy.

Data Limitations

When food supply data are used to examine dietary patterns, concerns always arise regarding differences noted between food supply data and dietary intake data. Food supply data measure food and nutrient availability as national totals; whereas, dietary survey data (such as USDA's Continuing Survey of Food Intakes by Individuals) provide data on food and nutrient intakes reported by individuals and households. Both types of data have strengths and limitations that affect their ability to measure food consumption and their usefulness in dietary assessment. Estimates of the food supply reflect the amount of food available before it moves through marketing channels, not the amount actually consumed. Thus food supply data typically overestimate food and nutrient availability and are better indicators of trends in consumption over time rather than actual amounts ingested. On the other hand, the quality of the dietary or food intake survey depends on the accuracy and completeness of the individual's recall. Underreporting of the total diet or different food groups by respondents is common in these surveys, and actual food intakes may be underrepresented.

Another concern: fortification and enrichment estimates. USDA and Italian nutrient databases do not routinely identify levels of added nutrients. Fortification data in the U.S. food supply have not been updated since 1970, except for the percentage of flour enriched. Since 1970, enormous changes in fortification practices by the food industry have occurred, and both the range of fortified foods and the number of added nutrients expanded.

⁶Despite higher levels of calcium in 1986-92, these levels are below the calcium recommendations for many subgroups of the population.

An updated version of USDA's food composition database, designed to include nutrients added to foods commercially through enrichment and fortification, is needed to generate more accurate estimates of nutrients in the food supply. Based on personal communications with Italian authorities, we found that enrichment and fortification are not commonly practiced in Italy. Therefore, the higher U.S. levels for thiamin, riboflavin, and niacin are most likely real and not from a difference in methods.

The ability of estimates of the food supply to reflect accurately the contribution of fat from the meat group is another concern. The contribution of red meat in the U.S. food supply has been completely revised (6), thus these estimates reflect more closely the trends in fat contributed by meat. The composition of red meat in Italy has also undergone a shift to more leaner types, and this is probably not reflected in the food composition values used for Italy. Thus the contribution of fat from meat is probably overestimated for Italy.

Because the Italian diet of the 1960's is no longer common, using it as a model is difficult. Many individuals would assume that the current Mediterranean diet is the model; as illustrated by this study, that assumption would be misleading. The effects on the health of those living in the Mediterranean area caused by changes in their diets require further research. The protective effect of the Mediterranean diet in terms of coronary heart disease may no longer exist, and perhaps the health of those currently living in the Mediterranean region would benefit by their returning to the diets of their grandparents.

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